width, and length are less than 10 cm. In some embodiments, the cartridge **700**, sample collection device **400**, and reader **2200** together form a system **2800** approximately the size of a smartphone or other mobile computing device. In some embodiments, the system is sized and configured to be portable. In such embodiments, in addition to a compact, handheld design, all liquids within the sample are properly sealed and separated such that no leaking or premature oxidation reactions will occur due to jostling of the system components while on the go.

To promote use by lay people in non-clinical settings, the system **2800** of some embodiments is designed to be "dummy proof" by including a self-activating and self-run detection protocol. For example, FIG. **28**B depicts an example in which the cartridge **700** has been placed into the dock **2210** of the reader **2200** and the sample collection device **400** has been inserted into the input tunnel **712** of the cartridge **700**. In the depicted embodiment, loading the cartridge **700** into the reader **2200** established an electrical connection between the pins of the cartridge **700** and the reader **2200**, thereby completing a circuit within the reader **2200**, which automatically activated the reader. Upon being activated, the reader **2200** of some embodiments activates its sonicator, if present, utilizing the sonicator to detect entry of a sample collection device **400** into the first reservoir. Upon detection, the reader **2200** of various embodiments is configured to initiate a detection protocol automatically without any further human intervention. The automated start ensures that mixing of reagents and sample within the first reservoir occurs consistently at a fixed time following insertion of the sample collection device, leading to consistent test results. In other embodiments, where no sonicator is present, the testing protocol may initiate when a user presses a "go", "run", "start", or other similar button or icon on the reader **2200** or a remote computing device **2820**.

As described in more detail below, and as shown in FIGS. **28**A and **28**B, in some embodiments, the system **2800** includes a remote computing device **2820**. The remote computing device **2820** may be a mobile computing device, such as, for example, a smartphone, tablet, or wearable device, or a laptop or other computer. As shown in FIG. **28**A, in some embodiments, the reader **2200** communicates with the remote computing device **2820** wirelessly. In other embodiments, a removable wired connection, such as a cable connection, is provided between the reader **2200** and the remote computing device **2820**. In still other embodiments, such as the embodiment of FIGS. **29**A and **29**B, an analyte reader **2910** having a cartridge docking station **2915**, within the system **2900**, removably couples to the remote computing device **2920** directly, for example, by connecting via a plug **2912** into a headphone jack or electrical charging port.

In various embodiments, the remote computing device may be included within the system: to provide for more computing power and/or more memory; to provide a wireless transceiver for pulling data from, and transmitting data to, a remote server; and/or to provide a display screen and user interface. A remote computing device is not needed within every embodiment. For example, as shown in FIG. **30**, in some embodiments, the reader **3000** includes a processor and memory (not shown), a dock **3015** for a cartridge, as well as a touchscreen or other user interface **3010**. In such embodiments, the reader is configured to identify the proper test protocol, run the test protocol, analyze the raw results received from the sensors in the system, and display digital results to a user. The reader of such embodiments may further include a wireless receiver and transmitter for accessing and transmitting data from remote servers.

One embodiment of an analyte detection system is shown schematically in FIG. **31**. FIG. **31** provides a schematic illustration of the interactions between computerized components within one embodiment of an analyte detection system **3100**. One skilled in the art will appreciate that the embodiment is illustrative in nature only and various components may be added, deleted, or substituted and various different hierarchies and modes of communication between the devices may be employed. In the depicted example, the detection system **3100** is formed of a plurality of computerized devices, including a reader **3130**, a device having a user interface **3140**, and a server **3150**. While not computerized, the system **3100** additionally includes a sample collection device **3110** and a cartridge **3120** shown coupled to the reader **3130**. It should be understood that in certain embodiments described with reference to FIG. **31**, the reader **3130** may represent any reader embodiment described elsewhere herein, such as for example, reader **2200**, reader **2910**, or reader **3000**. Similarly, the device having a user interface **3140** may represent any such device described herein, such as the mobile computing device **2820** or **2920**. The cartridge **2820** may represent any cartridge embodiment described herein, such as cartridge **700**, **800**, or **900** and the sample collection device **2810** may represent any sample collection device described herein, such as sample collection device **400** or **600**. The system **3100** includes a communication network **3160** through which some or all of the various devices communicate with one another. The network can be a local area network (LAN) or a wide area network (WAN). In some embodiments, the network is a wireless communication network, such as, for example, a mobile WiMAX network, LTE network, Wi-Fi network, or other wireless network. In other embodiments, the communication between the computer having a user interface **3140** and the server **3150** occurs over the internet via a wired network, such as a DSL cable connection.

In some embodiments, the reader **3130** and the device having a user interface **3140** are not separate devices, but rather, are both provided within the reader device **3130**, for example, as shown in FIG. **30**. In such embodiments, communication between the reader processor and the user interface occurs internally within the reader **3130** via the transmission of electrical signals.

In other embodiments, the reader **3130** and the device having a user interface **3140** are separate devices. In some embodiments, the device with the user interface **3140** is a smartphone or other mobile computing device. Communication between the reader **3130** and the mobile computing device **3140** may occur, wirelessly, for example, using Bluetooth®, near-field communications, or other radiofrequency technology. Alternatively, transmission of signals between the reader **3130** and the mobile computing device **3140** may occur over a cord, cable, or other wired or direct connection. In various embodiments, the mobile computing device or other device having a user interface **3140** includes a software application for a front-end, graphical user interface for presenting test results to a user.

In various embodiments, the reader **3130** is configured to control the tests and processes needed to detect and/or quantify target analyte within a sample. To do so, a significant amount of information may be stored within the memory of the reader **3130**. Alternatively, some or all of the information may be stored within the server **3150** and accessible by the reader **3130** via the communication network **3160**. Such information includes, for example a database of cartridge keys, which identifies each cartridge type by the signal generated by the cartridge's unique identifying resistor label. The information also includes test protocols associated with each